A Decade in Dental Care Utilization among Adults and Children (2001–2010)

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Objective. To decompose the change in pediatric and adult dental care utilization over the last decade.

Data. 2001 through 2010 Medical Expenditure Panel Survey.

Study Design. The Blinder-Oaxaca decomposition was used to explain the change in dental care utilization among adults and children. Changes in dental care utilization were attributed to changes in explained covariates and changes due to movements in estimated coefficients. Controlling for demographics, overall health status, and dental benefits variables, we estimated year-specific logistic regression models. Outputs from these models were used to compute the Blinder-Oaxaca decomposition.

Principal Findings. Dental care utilization decreased from 40.5 percent in 2001 to 37.0 percent in 2010 for adults and increased from 43.2 percent in 2001 to 46.3 percent in 2010 for children ($p < .05$). Among adults, changes in insurance status, race, and income contributed to a decline in adult dental care utilization (-0.018, $p < .01$). Among children, changes in controlled factors did not substantially change dental care utilization, which instead may be explained by changes in policy, oral health status, or preferences.

Conclusions. Dental care utilization for adults has declined, especially among the poor and uninsured. Without further policy intervention, disadvantaged adults face increasing barriers to dental care.

Key Words. Dental care utilization, decomposition, oral health, dental benefits

Oral health is a critical component of overall health. Oral health has been shown to be associated with cardiovascular disease, diabetes, and certain cancers, although the nature of the link is still not fully understood (Fitzpatrick and Katz 2010; Simpson et al. 2010; Teeuw, Gerdes, and Loos 2010; Azarpazhooh and Tenenbaum 2012; Lockhart et al. 2012). It has also been linked to health care costs, labor productivity, and wages (Cigna 2010; Glied and Neidell 2010). Along with prevention and good oral hygiene, a key driver of oral health is routine dental care (Institute of Medicine [IOM] 2011a,b). Recent years have seen a sharp increase in emergency room use for dental care, largely for preventable conditions that could have been

avoided with routine dental care at considerably lower cost (The Pew Center on the States 2012; Wall 2012).

Several studies have shown that the last decade has brought significant changes in utilization of dental care among the US population. Two recent studies based on data from the National Health Interview Survey (NHIS) (Kenney et al. 2012; Wall, Vujicic, and Nasseh 2012) show that the percent of the adult population with a dental visit in the last 12 months has been declining since the early 2000s. The trend is particularly pronounced for low-income adults (Wall, Vujicic, and Nasseh 2012). A key finding in both studies (Kenney et al. 2012; Wall, Vujicic, and Nasseh 2012) is that the downward trend was established well before the recent economic downturn. Among children, however, the trend in utilization of dental care is different from adults. The percent of children with a dental visit in the last 12 months increased from 74.2 percent in 2000 to 78.7 percent in 2010 (Kenney et al. 2012). Among poor children, the increase was much larger. For children below the federal poverty line, the utilization rate of dental care increased from 62 percent in 2000 to 71 percent in 2010 (Wall, Vujicic, and Nasseh 2012).

A number of factors appear to be contributing to the observed pattern of dental care utilization in the past decade. There has been widespread improvement in state Medicaid and Children Health Insurance Programs (CHIP). In the late 1990s and early 2000s, a number of states took dramatic steps to improve access to dental care among children covered by Medicaid and CHIP. Numerous states employed a variety of approaches, including raising reimbursement rates (Greene-McIntyre, Finch, and Searcy 2003; Hughes et al. 2005; Borchgrevink, Snyder, and Gehshan 2008; Centers for Medicare and Medicaid Services [CMS] 2011a; Decker 2011), revamping administrative structures and processes (Greene-McIntyre, Finch, and Searcy 2003; Hughes et al. 2005; Borchgrevink, Snyder, and Gehshan 2008; CMS 2011a), and conducting outreach and education to both providers and patients (Greene-McIntyre, Finch, and Searcy 2003; Borchgrevink, Snyder, and Gehshan 2008; CMS 2011a). CMS data show a clear record of improved children's access to dental care in Medicaid/CHIP programs. Approximately 40 percent of children in Medicaid received a dental service

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in 2009, reflecting a nearly 50 percent increase over the 27 percent of children who received a dental service in 2000. These improvements occurred during a period when the number of children enrolled in Medicaid/CHIP grew from 23 to 33 million (CMS 2011b). This achievement was supported by significant increases in funding for children's dental services within Medicaid programs. Between 1990 and 2010, Medicaid dental expenditures grew from $756.1 million to $7.4 billion or from 2.4 to 7.1 percent of total dental expenditures (CMS 2012).

The last decade has seen widespread reductions in adult dental benefits within Medicaid programs as well as in employer-sponsored dental benefits (American Dental Association [ADA] 2012a). Due to fiscal constraints, numerous states (CA, IL, IN, MD, MA, MI, MN, MO, MT, NJ, PA, SD, TN, UT, and WA) decreased dental benefits coverage for adults within Medicaid since 2002 (Wall, Nasseh, and Vujicic 2013). Although states are required to cover dental services for low-income children in Medicaid under the Early and Periodic Screening, Diagnostic, and Treatment benefit, Medicaid coverage for dental services for adults is optional (Medicaid.gov Undated). Availability of dental benefits has an important impact on utilization of dental care (Brown et al. 2009).

Changes in provider behavior might also account for some of the trends in dental care utilization. Since 2000, there has been an increase in provider participation in public programs. The most recent data from the American Dental Association indicate that nationally, the percentage of patients on public assistance who visit private practice dentists has increased from 4.7 percent in 2000 to 7.0 percent in 2009 (ADA 2012b). Some authors have also suggested that new care delivery models have emerged that take advantage of economies of scale and are able to treat patients at lower average cost. These models may be able to treat more Medicaid patients despite the fact that Medicaid programs typically pay well below market fees (Edelstein 2012; Winegarden and Arduin 2012).

In this article, we examine trends in the utilization of dental care among the U.S. population from 2001 to 2010 and identify the relative importance of various factors in explaining the trends. Specifically, we use econometric analysis to decompose the change in utilization of dental care for both children and adults that is due to changes in demographic factors (age, education, marital status, race, region, and gender), family income, dental benefits status, and overall personal health status. To our knowledge, this is the first study that attempts to quantify the relative contribution of various factors in explaining the pattern of dental care utilization over this

period. Our results show different utilization patterns for children and adults, and a different set of factors driving these patterns. We discuss the policy implications, particularly in light of an aging population, changing demographics, and continued fiscal austerity within state Medicaid programs. The downward trend in adult utilization—particularly among the disadvantaged—is troubling and could signal continued challenges in the future when providing dental care to this group.

STUDY DATA AND METHODS

Data Source

We use data from the household component (HC) of the Medical Expenditure Panel Survey (MEPS) to track and decompose dental care utilization from 2001 through 2010. MEPS is a nationally representative survey of adults and their children maintained by the Agency for Healthcare Research and Quality (AHRQ). Since 2001, approximately 13,000 families and 33,000 individuals have been included in each year of the HC-MEPS (AHRQ 2009a), which is built off a nationally representative subsample of the NHIS. Data contained in the HC include information on demographics, health conditions, health status, payment charges, access to care, health insurance coverage, family income, employment status, and utilization of medical services (AHRQ 2009b). Unlike the NHIS, MEPS asks individuals whether they have private dental benefits provided by a private plan or employer. This is a crucial advantage of the MEPS.

Study Sample and Variable Definitions

We used data from the 2001 through 2010 MEPS to trend dental care utilization over time.[1] Our measure of dental care utilization is whether an individual visited a general practice (GP) dentist during the year. In the MEPS, a GP dentist is defined as an oral health provider who is not a dental hygienist, dental technician, dental surgeon, orthodontist, endodontist, or periodontist. We separately analyzed nonelderly adults aged 19 through 64 and children aged 2 through 18. In our trend analysis, 186,777 individuals were included in our adult cohort and 91,366 were included in our child cohort. In our multivariate decomposition analysis, we only used data from the 2001 and 2010 MEPS, which included data on 35,412 adults and 16,353 children. For adults, the independent variables included in the

multivariate analysis include a dummy variable for marital status (married or not married), age, gender, years of education, a categorical variable for the federal poverty level (FPL) (FPL < 100 percent, 100 < FPL ≤ 200 percent, 200 < FPL ≤ 400 percent, >400 percent FPL), dummy variables for census region (Northeast, Midwest, South, or West), a dummy variable for urban/rural residence, a categorical variable for dental benefits status (private dental benefits, public health insurance, or uninsured), a dummy variable for poor or fair self-reported health, a dummy variable for overweight/obesity (BMI > 25), and a categorical variable for ethnicity/race (Non-Hispanic white, Non-Hispanic black, Hispanic, or other). Medicaid/CHIP is included under public health insurance for adults and children. In the multivariate decomposition analysis for children, we excluded marital status and the dummy variable for overweight/obesity.[2] Instead of the child's education, parent's education is included in the multivariate analysis.[3]

Methodology

To analyze the impact that ethnicity/race, insurance status, income, and other variables had on dental care utilization, we implemented a nonlinear version of the Blinder-Oaxaca decomposition technique (Blinder 1973; Oaxaca 1973). The Blinder-Oaxaca technique decomposes differences between groups into "explained" changes in the levels of various explanatory variables (endowment effect) and "unexplained" changes in the levels of various coefficients (coefficient effect). Typically, the Blinder-Oaxaca decomposition is used to explain differences between groups, such as the poor and nonpoor. The technique has been applied in the labor market, discrimination, and health inequity literature (Stanley and Jarrell 1998; Weichselbaumer and Winter-Ebner 2005; O'Donnell et al. 2008). The Blinder-Oaxaca technique has also been used to decompose changes over time (Smith and Welch 1989; Le and Miller 2004). Due to the binary nature of the dependent variable, we implement a nonlinear logit version of the Blinder-Oaxaca decomposition as implemented by a recent study (Yun 2004). For comparison, we also estimate the linear version of the Blinder-Oaxaca decomposition. To decompose the change in the percentage of children and adults with a GP dental visit during a calendar year, we estimate separate linear probability and logit models for 2001 and 2010. Outputs from these separate models are then used to estimate the endowment and coefficient effects. The following equation shows the components of a nonlinear Blinder-Oaxaca decomposition:

$$\text{Utiliz}_{2001} - \text{Utiliz}_{2010} = \{\overline{F(x'_{i2001}b_{2001})} - \overline{F(x'_{i2010}b_{2001})}\} - \{\overline{F(x'_{i2010}b_{2001})} - \overline{F(x'_{i2010}b_{2010})}\}$$
$$= \{E\} + \{C\}$$

(1)

where $\{E\}$ is the change due to "endowments" and $\{C\}$ is the change due to different coefficients over time. $F(-)$ represents a nonlinear logit function. The delta method is used to derive the standard errors needed to perform inference on the estimated decomposition estimates derived from Equation (1). Based on Equation (1), a first-order Taylor expansion is used to derive weights needed to estimate the detailed contribution that each covariate has toward the decomposition (Yun 2004). For categorical and binary regressors, results for the detailed composition depend on the choice of the omitted or base category. Using a normalization restriction, detailed results are computed using a deviation contrast from the grand mean (Yun 2005).

We rely on previous research to identify important explanatory variables for dental care utilization (Manning and Phelps 1979; Manski, Macek, and Moeller 2002; Wang, Norton, and Rozier 2007; Brown et al. 2009; Choi 2011). These include demographic variables (age, gender, education, marital status, and ethnicity/race), family income, health status variables (body-mass index and self-reported health status), and insurance status (private dental benefits, public health insurance, and uninsured).

All estimates, standard errors, and computed t-statistics account for the complex sampling design of the MEPS. All analysis was conducted using STATA 11 (StataCorp, College Station, TX, USA).

Sensitivity Analysis

We estimated a version of our analysis for adults where we include a binary variable for edentulism, as a proxy for dental care need. Previous research has shown that rates of edentulism have declined, particularly among the geriatric population (Cunha-Cruz, Hujoel, and Nadanovsky 2007; Centers for Disease Control and Prevention [CDC] 2010). Edentulism is when an individual has no natural teeth. We also duplicated our analysis using whether an individual has visited any type of oral health provider over the year as our dependent variable. In addition to capturing visits to GP dentists, the MEPS documents visits to any type of oral health provider which includes GP dentists, dental hygienists, dental technicians, dental surgeons, orthodontists, endodontists, or

periodontists.[4] Finally, we checked the robustness of our results by altering the endpoints in our decomposition analysis to 2002 and 2009.

Limitations

Even though we have controlled for a number of health-related and demographic factors in our decomposition models, we did not control for dental reimbursement fees. Unfortunately, MEPS does not have zip code or state level identifiers that would allow us to merge Medicaid or commercial dental reimbursement fee rates to the MEPS. Higher Medicaid payment levels to dentists have been shown to be associated with higher rates of dental care utilization among children and adolescents (Decker 2011). MEPS does not include a measure of oral health status, which potentially influences dental care utilization. Our outcome variable is also a limited measure that determines whether someone had GP dental visit during the year. Based on the data available, we cannot measure the quality of dental care a patient receives over a 12-month period.

RESULTS

Figure 1 plots the percentage of children (age 2–18) and adults (age 19–64) with a GP dental visit during the year from 2001 through 2010. The percentage of children with a GP dental visit during the year rose from 43.2 percent in 2001 to 46.3 percent in 2010. Interestingly, dental care utilization for children dipped in 2008 before recovering in 2009 and 2010, which may suggest that the recession had an impact during this period. For adults, the percent with a GP dental visit during the year has steadily declined from 41.2 percent in 2003 to 37.0 percent in 2010.

Table 1 shows the key outcome variable—dental care utilization—and the weighted means of the key explanatory variables that are used in the multivariate decomposition model for adults. Several interesting changes are worth noting. Compared to 2001, the 2010 adult population is older and slightly more educated. In 2010, more adults are overweight or obese and more report fair or poor health. The percentage of adults in poverty increased from 9.9 percent in 2001 to 13.4 percent in 2010 while the percentage of high-income earners (>400 percent FPL) decreased from 44.2 percent to 40.0 percent in 2010. Fewer adults had private dental benefits in 2010 (56.4 percent) than in 2001 (61.7 percent). Meanwhile, the percentage of adults on public health insurance

Figure 1: Percent with a General Practice Dental Visit during the Year, 2001–2010
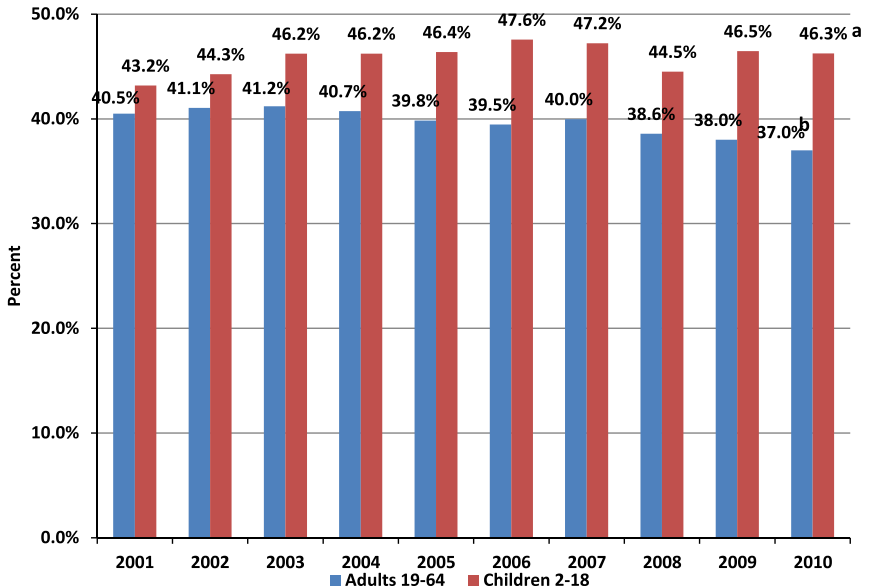
Note. Number of adults: 186,777; number of children: 91,366. (a) Significantly different from 2001 at .05 level, two-tailed test. (b) Significantly different from 2001 at .01 level, two-tailed test. Estimates weighted. Significance tests account for the complex survey design of MEPS.
Source. Medical Expenditure Panel Survey.

or without any insurance increased significantly from 2001 to 2010. In other words, there has been a significant shift away from private dental benefits toward public health insurance (where adult dental benefits are very limited) and no dental benefits among the adult population. There are fewer white and more Hispanic adults in 2010 relative to 2001.

   Table 2 shows the same descriptive statistics for children. Parental education levels increased from 2001 to 2010. Fewer children were in poor or fair health. The percentage of children living in poverty increased from 16.2 percent in 2001 to 21.3 percent in 2010. Fewer children had private dental benefits but unlike adults, fewer also had no dental benefits. The percentage of children covered by public health insurance rose significantly from 23 percent in 2001 to 35.5 percent in 2010. The percentage of non-Hispanic white children fell from 61.7 percent in 2001 to 54.8 percent in 2010. The percentage of Hispanic children rose from 17.4 percent to 22.7 percent.

Table 1:   Weighted Means of Dental Care Utilization and Key Explanatory Variables, Adults Aged 19–64, 2001 and 2010

Variable	2001		2010		2010–2001	
	Mean	SD	Mean	SD	Difference	Sig. Level
GP dental visit during the year	0.405	0.477	0.370	0.469	−0.035	***
No. of GP dental visits during the year	0.849	1.450	0.698	1.168	−0.152	***
Any dental visit during the year	0.431	0.494	0.393	0.462	−0.037	***
No. of dental visits during the year	1.014	1.767	0.819	1.334	−0.195	***
Age	40.090	12.045	41.162	12.730	1.072	***
Years of education	13.067	2.709	13.468	2.567	0.402	***
Fair or poor self-reported health	0.186	0.378	0.200	0.389	0.014	**
Overweight or obese	0.597	0.476	0.650	0.463	0.053	***
<100% FPL	0.099	0.290	0.134	0.331	0.034	***
100–200% FPL	0.151	0.348	0.162	0.357	0.010	
200–400% FPL	0.307	0.448	0.305	0.447	−0.002	
>400% FPL	0.442	0.482	0.400	0.476	−0.042	***
Northeast	0.191	0.382	0.182	0.374	−0.009	
Midwest	0.232	0.410	0.216	0.400	−0.016	
South	0.350	0.463	0.368	0.468	0.018	
West	0.227	0.407	0.234	0.411	0.008	
Married	0.582	0.479	0.539	0.484	−0.043	***
Metropolitan statistical area	0.821	0.372	0.849	0.348	0.028	*
Private dental insurance	0.617	0.472	0.564	0.482	−0.053	***
Public insurance	0.065	0.239	0.093	0.282	0.028	***
Uninsured	0.318	0.452	0.343	0.461	0.025	**
Male	0.490	0.486	0.494	0.486	0.003	
Non-Hispanic white	0.706	0.442	0.654	0.462	−0.052	***
Non-Hispanic black	0.117	0.312	0.121	0.317	0.004	
Non-Hispanic other	0.049	0.209	0.071	0.250	0.023	***
Hispanic	0.128	0.325	0.154	0.351	0.026	**
Edentulism	0.065	0.246	0.043	0.192	−0.022	***

Note. Mean estimates are weighted. Test statistics account for the complex survey design of the MEPS. Statistical significance of age, education, number of GP visits, and number of any dental visits assessed with a comparison of means *t*-test. Significance of all other variables assessed with a chi-square test. 2001 number of observations: 18,486. 2010 number of observations: 18,186. Significant at: ***1% level; **5% level, *10% level.
Source. Medical Expenditure Panel Survey, 2001 and 2010.

Tables 3 and 4 present results from the multivariate linear probability and logit models separately for adults and children for 2001 and 2010. These models measure the relationship between the dependent variable, whether an individual had a GP dental visit during the year, and the explanatory variables described previously. The estimated coefficients are all of the expected sign, and we focus only on highlighting what we feel are

Table 2:   Weighted Means of Dental Care Utilization and Key Explanatory Variables, Children Aged 2–18, 2001 and 2010

Variable	2001		2010		2010–2001	
	Mean	*SD*	*Mean*	*SD*	*Difference*	*Sig. Level*
GP dental visit during the year	0.432	0.517	0.463	0.528	0.031	**
No. of GP dental visits during the year	0.714	1.100	0.760	1.114	0.046	
Any dental visit during the year	0.477	0.536	0.505	0.516	0.028	**
No. of dental visits during the year	1.258	2.484	1.164	2.027	−0.094	
Age	10.052	5.091	9.994	5.263	−0.059	
Years of parent's education	13.434	2.912	13.840	2.839	0.406	***
Fair or poor self-reported health	0.060	0.247	0.049	0.229	−0.010	**
<100% FPL	0.162	0.385	0.213	0.433	0.051	***
100–200% FPL	0.215	0.429	0.209	0.431	−0.006	
200–400% FPL	0.327	0.490	0.299	0.485	−0.028	**
>400% FPL	0.296	0.477	0.279	0.475	−0.017	
Northeast	0.168	0.390	0.165	0.393	−0.003	
Midwest	0.217	0.431	0.215	0.435	−0.003	
South	0.369	0.504	0.377	0.513	0.008	
West	0.246	0.450	0.243	0.455	−0.002	
Metropolitan statistical area	0.821	0.401	0.846	0.382	0.025	
Private dental insurance	0.573	0.517	0.488	0.529	−0.086	***
Public insurance	0.230	0.440	0.355	0.507	0.125	***
Uninsured	0.196	0.415	0.157	0.386	−0.039	***
Male	0.511	0.522	0.511	0.530	−0.001	
Non-Hispanic white	0.617	0.508	0.548	0.527	−0.069	***
Non-Hispanic black	0.157	0.380	0.142	0.369	−0.015	
Non-Hispanic other	0.052	0.233	0.084	0.294	0.032	***
Hispanic	0.174	0.396	0.227	0.444	0.053	***

Note. Mean estimates are weighted. Test statistics account for the complex survey design of the MEPS. Statistical significance of age, education, and number of GP visits and number of any dental visits assessed with a comparison of means *t*-test. Significance of all other variables assessed with a chi-square test. 2001 number of observations: 8766. 2010 number of observations: 8,345. Significant at: ***1% level; **5% level.
Source. Medical Expenditure Panel Survey, 2001 and 2010.

some of the important findings. First, the negative effect of public health insurance relative to private dental benefits is much smaller for children than for adults. For example, in 2001 an adult with public health insurance was 12.9 percentage points less likely to have a dental visit compared to an adult with private dental benefits. For children, the effect was only 5.4 percentage points. This finding is not surprising since all state Medicaid/CHIP programs provide comprehensive dental benefits, but most states provide

Table 3: Linear Probability Model and Logit Estimates Adults Aged 19–64, 2001 and 2010

	(1) LPM 2001	(2) LPM 2010	(3) Logit 2001	(4) Logit 2010
Urban	0.018 (0.012)	0.006 (0.017)	0.088 (0.059)	0.035 (0.088)
Married	0.006 (0.010)	−0.009 (0.009)	0.020 (0.046)	−0.051 (0.046)
Age	0.003*** (0.0004)	0.003*** (0.0004)	0.015*** (0.002)	0.017*** (0.002)
Education	−0.021*** (0.006)	−0.029*** (0.006)	−0.066** (0.033)	−0.080* (0.048)
Education squared	0.002*** (0.0003)	0.002*** (0.0003)	0.007*** (0.001)	0.008*** (0.002)
Overweight or obese	−0.007 (0.008)	−0.024** (0.010)	−0.022 (0.041)	−0.121** (0.052)
Poor or fair health	−0.043*** (0.009)	−0.028** (0.011)	−0.210*** (0.048)	−0.143** (0.062)
FPL 100–200%	−0.016 (0.015)	−0.024* (0.013)	−0.059 (0.089)	−0.103 (0.085)
FPL 200–400%	0.020 (0.015)	−0.003 (0.014)	0.154* (0.085)	0.048 (0.091)
FPL >400%	0.094*** (0.015)	0.062*** (0.017)	0.471*** (0.083)	0.330*** (0.099)
Midwest	0.026* (0.014)	0.051** (0.023)	0.116* (0.067)	0.244** (0.115)
South	−0.035** (0.015)	−0.040* (0.021)	−0.174** (0.071)	−0.220** (0.107)
West	−0.023 (0.017)	0.015 (0.021)	−0.114 (0.078)	0.081 (0.107)
Public insurance	−0.129*** (0.017)	−0.201*** (0.015)	−0.559*** (0.092)	−0.925*** (0.092)
Uninsured	−0.197*** (0.010)	−0.262*** (0.012)	−0.950*** (0.048)	−1.326*** (0.065)
Male	−0.099*** (0.007)	−0.075*** (0.008)	−0.481*** (0.035)	−0.391*** (0.042)
Non-Hispanic black	−0.146*** (0.013)	−0.077*** (0.013)	−0.740*** (0.069)	−0.406*** (0.070)
Other race	−0.111*** (0.025)	−0.089*** (0.016)	−0.520*** (0.121)	−0.445*** (0.087)
Hispanic	−0.071*** (0.013)	−0.058*** (0.013)	−0.379*** (0.068)	−0.360** (0.079)
Constant	0.361*** (0.042)	0.389*** (0.059)	−0.892*** (0.247)	−1.023*** (0.405)
R-square	0.1429	0.1798		
Observations	17,927	17,485	17,927	17,485

Note. Dependent variable is a 0/1 indicator variable that measures whether an individual had a GP dental visit during the year. Estimates are weighted and standard errors take into account the complex survey design of the MEPS. Standard errors in parentheses.
Significant at: *** 1% level; ** 5% level; * 10% level.
Race reference category: non-Hispanic white; region reference category: Northeast; income reference category: FPL <100%; insurance reference category: private dental insurance; a squared term for education is included due to a significant nonlinearity in this variable.
Source. Medical Expenditure Panel Survey 2001 and 2010.

Table 4: Linear Probability Model and Logit Estimates Children Aged 2–18, 2001 and 2010

	(1) LPM 2001	(2) LPM 2010	(3) Logit 2001	(4) Logit 2010
Urban	−0.018 (0.021)	0.074*** (−0.028)	−0.088 (0.101)	0.336*** (0.130)
Age	0.094*** (0.005)	0.077*** (0.007)	0.458*** (0.027)	0.348*** (0.032)
Age squared	−0.004*** (0.0003)	−0.004*** (0.0003)	−0.020*** (0.001)	−0.016*** (0.002)
Education	−0.016 (0.010)	−0.040*** (0.015)	−0.038 (0.064)	−0.176*** (0.066)
Education squared	0.002*** (0.0005)	0.002*** (0.001)	0.007** (0.003)	0.011*** (0.003)
Poor or fair health	−0.0006 (0.026)	0.010 (0.026)	−0.017 (0.133)	0.045 (0.113)
FPL 100–200%	0.006 (0.023)	0.014 (0.026)	0.058 (0.121)	0.065 (0.118)
FPL 200–400%	0.041* (0.025)	0.015 (0.028)	0.225* (0.125)	0.070 (0.128)
FPL >400%	0.116*** (0.028)	0.058* (0.034)	0.556*** (0.136)	0.260* (0.152)
Midwest	0.034 (0.026)	0.051 (0.034)	0.155 (0.124)	0.223 (0.153)
South	0.004 (0.023)	−0.006 (0.032)	0.016 (0.109)	−0.030 (0.145)
West	−0.007 (0.027)	0.021 (0.034)	−0.036 (0.129)	0.091 (0.153)
Public insurance	−0.054** (0.022)	−0.050* (0.028)	−0.221** (0.105)	−0.189 (0.122)
Uninsured	−0.197*** (0.019)	−0.261*** (0.028)	−0.930*** (0.094)	−1.18*** (0.138)
Male	−0.008 (0.012)	−0.012 (0.012)	−0.041 (0.056)	−0.057 (0.055)
Non-Hispanic black	−0.134*** (0.025)	−0.060*** (0.023)	−0.623*** (0.119)	−0.266*** (0.102)
Other race	−0.189*** (0.040)	−0.058* (0.033)	−0.880*** (0.199)	−0.255* (0.145)
Hispanic	−0.067*** (0.020)	−0.055** (0.024)	−0.310*** (0.098)	−0.239** (0.109)
Constant	−0.038 (0.077)	0.198 (0.102)	−2.872*** (0.476)	−1.426*** (0.458)
R-square	0.1503	0.1076		
Observations	8,373	7,980	8,373	7,980

Note. Dependent variable is a 0/1 indicator variable that measures whether an individual had a GP dental visit during the year. Estimates are weighted and standard errors take into account the complex survey design of the MEPS. Standard errors in parentheses.
Significant at ***1% level; **5% level; *10% level.
Race reference category: non-Hispanic white; region reference category: Northeast; income reference category: FPL <100%; insurance reference category: private dental insurance; due to a significant nonlinearity in age and parent's education, squared terms for these variables are included.
Source. Medical Expenditure Panel Survey 2001 and 2010.

only very limited adult dental benefits. The negative effect of being uninsured for dental benefits is very similar for adults and children—a decrease in the probability of having a dental visit of around 20 percentage points relative to having private dental benefits. Second, the negative effect on utilization of having public health insurance versus private dental benefits increased for adults. In 2001, it was 12.9 percentage points and by 2010, it increased to 20.1 percentage points. It remained stable at around 5 percentage points for children. This is not surprising given the significant erosion of dental benefits within adult Medicaid programs for adults but not children this past decade. Third, the negative effect on utilization of being uninsured versus having private dental benefits grew significantly for both adults and children. These findings clearly suggest that having dental benefits is becoming increasingly important in influencing utilization. Fourth, among both adults and children, racial effects were smaller in 2010 compared to 2001, particularly among non-Hispanic blacks. For example, all else equal, non-Hispanic black children were 13.4 percentage points less likely to have a dental visit in 2001. This decreased to only 6.0 percentage points by 2010.

Table S1 shows the linear and logit Blinder-Oaxaca decomposition results for adults.[5] Approximately 24 percent of the drop in GP dental care utilization from 2001 through 2010 can be explained by changes in endowments while 76 percent of the drop in utilization can be accounted for by changes in coefficients or unexplained factors. Lower levels of income, higher rates of fair/poor self-reported health, changes in the racial composition of the adult population (fewer non-Hispanic whites, more Hispanics), and changes in insurance status lowered GP dental care utilization from 2001 through 2010. As shown in Table 1, fewer adults had private dental benefits in 2010 and more were either uninsured or had public health insurance. Changes in the distribution of insurance coverage alone accounted for about 24 percent of the drop in GP dental care utilization among adults—by far the biggest factor. An older and slightly more educated adult population acted to drive up GP dental care utilization in the last decade. The unexplained factors, including an increase in the magnitude of the effect of private dental benefits, could have been driven by changes in preferences, changes in fee levels, or an erosion of adult dental benefits within state Medicaid programs.

Among children, most of the increase in GP dental care utilization was accounted by changes in coefficients or unexplained factors, which in turn could be driven by changes in preferences, policy at the state level, or dental re-imbursement fees (Table S2). For example, if states undertook Medicaid

program reforms (e.g., patient and dentist outreach), this would show up in unexplained factors. Little of the increase in utilization can be tied back to changes in endowments.

Sensitivity Analysis

Table S3 shows the Blinder-Oaxaca decomposition results for adults, controlling for edentulism. Approximately 14 percent of the drop in GP dental care utilization from 2001 through 2010 can be explained by changes in endowments while 86 percent of the drop in utilization can be accounted for by changes in coefficients or unexplained factors. The changes due to "endowments" are similar in magnitude to our findings in the model that does not control for edentulism. As shown previously, lower levels of income, higher rates of fair/poor self-reported health, changes in the racial composition of the adult population (fewer non-Hispanic whites, more Hispanics), and changes in insurance status are the key factors accounting for the decline in GP dental care utilization from 2001 through 2010. Shifts away from private dental benefits toward public health insurance or uninsured status accounted for about 26 percent of the drop in GP dental care utilization among adults. Lower rates of edentulism in 2010 relative to 2001 acted to increase GP dental care utilization among adults.

   Table S4 shows the Blinder-Oaxaca decomposition results for adults when any type of dental visit is used as the dependent variable. These results are consistent with the GP dental visit model (Table S1). About 24 percent of the drop in dental care utilization from 2001 through 2010 can be explained by changes in endowments, while 76 percent of the drop in utilization can be accounted for by changes in coefficients or unexplained factors. Decreases in family income account for about 13 percent of the decrease in dental care utilization while shifts in insurance status toward public health insurance or uninsured status account for 24 percent of the drop in dental care utilization. Shifts in the ethnic and racial make-up of the population also accounted for the drop in dental care utilization among adults.

   Table S5 shows the Blinder-Oaxaca decomposition results for children when any type of dental visit is used as the dependent variable. As in our GP dental utilization model for children (Table S2), most of the increase in any dental care utilization was accounted by changes in "coefficients" or unexplained factors.

   Table S6 and S7 show the Blinder-Oaxaca decomposition results for adults and children with 2002 and 2009 were used as endpoints. For adults,

the results are similar to our earlier model (Table S1). Approximately 27 percent of the drop in GP dental care utilization from 2002 through 2009 was due to changes in "endowments," while 73 percent of the drop in dental care utilization was due to changes in "coefficients." Decreases in family income and a shift away from private dental benefits were the main contributing factors to a decline in GP dental care utilization between 2002 and 2009. For children, as in our original analysis (Table S2), changes in observed factors accounted for very little of the observed increase.

DISCUSSION

Dental care utilization trends have proved to be vastly different for adults and children over the past decade. From 2001 through 2010, utilization increased among children and decreased among adults. The factors driving the shifts in utilization are also very different for adults compared to children. Over the course of the decade, adults were less likely to have private dental benefits and were more likely to have public health insurance or no dental benefits, which significantly contributed to the decline in dental care utilization. An increase in poverty and a lower percentage of high-income earners also dampened dental care utilization. Over the course of the decade, the dental care utilization gap between those with private dental benefits and the uninsured grew significantly among adults. As we noted, factors such as changes in oral health status, state Medicaid policies, dental reimbursement fees, or preferences could also have had a significant role in driving down utilization among adults.

Dental care utilization among children increased in the last decade, but the factors that we control for in our model (race, parent's education, age, income, insurance status, health status, gender, and region) cannot explain the increase. In fact, demographic trends for children mirrored the same trends for adults. The changing racial composition among children (fewer non-Hispanic whites and more Hispanics) and lower family incomes, all else equal, would act to drive down utilization. For children, our analysis indicates factors that we could not control for, such as changes in preferences, dental reimbursement fees, or state Medicaid/CHIP policies, could have acted to increase dental care utilization. Several studies have, in fact, shown that the past decade has brought improvements in access to dental care for children in Medicaid/CHIP programs, resulting in increased utilization (Borchgrevink, Snyder, and

Gehshan 2008; Government Accountability Office [GAO] 2010; CMS 2011a; Bailit and D'Adamo 2012; Edelstein 2012).

A significant shortcoming of our analysis is that we are not able to control for oral health status, a key driver of dental care utilization, as we have no adequate measure in our dataset. Based on data from the National Health and Nutrition Examination Survey, for adults aged 20 and above, the percentage with untreated dental caries declined from 28.2 percent in 1988–1994 to 23.1 percent in 2005–2008 (CDC 2010). Although this metric is an imperfect measure of oral health, we believe that these trends may have contributed to the decline in dental care utilization among adults, but further work is needed in this area. Among children and adolescents aged 6 through 19, the percentage with untreated dental caries also declined from 23.6 percent in 1988–1994 to 16.2 percent in 2005–2008 (CDC 2010). By the same rationale, improvements in oral health among children, all else equal, could have put downward pressure on dental care utilization. However, utilization increased, further confirming the critical role of changes in policy and preferences that our findings suggest.

Our analysis, we feel, provides evidence that there are differences for adults and children in the effectiveness of the dental care safety net. During the past decade, both adults and children were less likely to have private dental benefits and more likely to be covered by Medicaid/CHIP or, in the case of adults, more likely to go without dental benefits as well. For children, the shift away from private dental benefits (as well as no dental benefits) toward Medicaid/CHIP has not resulted in a decrease in dental care utilization. For children, the dental care safety has experienced a decade of progress, at least measured by the share of children who see a dentist. Since many state Medicaid programs do not provide comprehensive dental benefits for adults (Myers 2011), the shift away from private dental benefits has adversely affected dental care utilization. More adults are also relying on hospital emergency rooms for dental care. A recent analysis showed that between 1997–1998 and 2007–2008 dental emergency department (ED) visits increased from 1.15 percent to 1.87 percent of total ED visits, with the largest increase among young adults aged 20–34 (Wall 2012). All of these factors suggest that the dental care safety net is weakening for adults.

We feel that the decline in adult utilization—and its core drivers—is of considerable concern and deserves the attention of policy makers. As states struggle with fiscal challenges, and given that adult dental care is not an essential benefit under the Affordable Care Act (Discepolo and Kaplan 2011), we believe that there are likely to be constraints to expanding adult dental benefits

significantly within Medicaid programs in the coming years. If the downward trend in the share of the adult population with private dental benefits continues, access to dental care utilization could continue to decline among adults. Moreover, if dental benefits for children are altered within the next CHIP reauthorization or, more broadly, within any future revisions to the Affordable Care Act, the progress made this past decade in access to dental care for children could stall, with important implications for oral and whole-body health.

ACKNOWLEDGMENTS

NOTES

1. MEPS does not capture private dental benefits coverage prior to 1999. Due to budgetary constraints, MEPS had limited sample sizes in 1999 and 2000. The AHRQ recommended that 2001 be the reference point for this analysis.
2. MEPS only calculates BMI for children aged 6 through 17.
3. The highest level of the mother's or father's education is assigned to children aged 18 and under. If a child lives in a single-parent household, then the education level of that parent is assigned to the child.
4. The MEPS does not ask survey respondents whether their child has seen a pediatric dentist and does not consider them specialists. Based on our conversations with the AHRQ, it is believed that survey respondents would classify a pediatric dentist as a GP dentist.
5. Our results for the linear and logit Blinder-Oaxaca decomposition models do not significantly differ.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Table S1. Linear and Logit Blinder-Oaxaca Decomposition. GP Dental Visit during the Year, Adults Aged 19–64.

Table S2. Linear and Logit Blinder-Oaxaca Decomposition. GP Dental Visit during the Year, Children Aged 2–18.

Table S3. Linear and Logit Blinder-Oaxaca Decomposition. GP Dental Visit during the Year, Adults Aged 19–64. Model with Edentulism.

Table S4. Linear and Logit Blinder-Oaxaca Decomposition. Any Dental Visit during the Year, Adults Aged 19–64.

Table S5. Linear and Logit Blinder-Oaxaca Decomposition. Any Dental Visit during the Year, Children Aged 2–18.

Table S6. Linear and Logit Blinder-Oaxaca Decomposition. GP Dental Visit during the Year, Adults Aged 19–64.

Table S7. Linear and Logit Blinder-Oaxaca Decomposition. GP Dental Visit during the Year, Children Aged 2–18.

Appendix SA1: Author Matrix.